



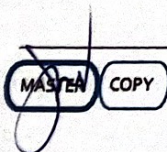
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2025.07.09



UNIVERSITY OF SOUTHERN MINDANAO					
Course Number	Math 221a	Course Title	Differential Equations I	Rev. No.	Ø
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INSTITUTIONAL POLICIES	
Vision	Quality and relevant education for its clientele to be globally competitive, culture sensitive and morally responsive human resources for sustainable development.
Mission	Help accelerate socio-economic development <sup>M2</sup> , promote harmony among the diverse cultures <sup>M2</sup> and improve quality of life <sup>M3</sup> through instruction, research, extension and resource generation in Southern Philippines.
Core Values	G-Goodness, R-Responsiveness, E-Excellence, A-Assertion of Right and T-Truth
USM Quality Policy Statement	<p>The University of Southern Mindanao, as a premier university, is committed to provide quality instruction, research development and extension services and resource generation that exceed stakeholders' expectations through the management of continual improvement efforts on the following initiatives.</p> <ol style="list-style-type: none"><li>1. Establish key result areas and performance indicators across all mandated functions;</li><li>2. Implement quality educational programs;</li><li>3. Guarantee competent educational service providers;</li><li>4. Spearhead need-based research outputs for commercialization, publication, patenting, and develop technologies for food security, climate change mitigation and improvement in the quality of life;</li><li>5. Facilitate transfer of technologies generated from research to the community for sustainable development;</li><li>6. Strengthen relationship with stakeholders;</li><li>7. Sustain good governance and culture, sensitivity; and</li><li>8. Comply with customer, regulatory and statutory requirements.</li></ol>
Goals of the College	<ol style="list-style-type: none"><li>1. The College of Science and Mathematics of the University of Southern Mindanao is committed to the comprehensive preparation of the next generation of scientists and mathematicians in this part of the country.</li><li>2. The College supplies a condition in which faculty can advance and support high-quality research programs in which students can collaborate and contribute to new knowledge that improves quality of life.</li><li>3. The College aspires to be the center of excellence in Science and Mathematics in order to serve diverse students, preparing them for their future careers in line with the vision and mission of the University.</li><li>4. The College serves the community and the industry as an impartial source of quality graduates in Science and Mathematics that provides education, literacy, innovation and solution generation to challenges.</li></ol>
Department Objectives	The Department of Mathematics and Statistics aims to: 1. produce students with mastery in the core areas of mathematics and statistics, including algebra, analysis, and geometry; 2. develop students' skills in pattern recognition, generalization, abstraction, critical analysis, synthesis, problem-solving and rigorous argument; 3. express an enhanced perception of the vitality and importance of mathematics in the modern world including inter-relationships within math and its connection to other disciplines; and 4. develop students' skills in creating and evaluating mathematical conjectures and arguments, and in validating their own mathematical thinking.





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PROGRAM INFORMATION					
Degree Program	Bachelor of Science in Applied Mathematics	CHED CMO Reference	48 series of 2017	BOR Approval	BOR Res. No. 24, s 2020

COURSE DETAILS					
Course Title	Differential Equations I				
Course Number	Math 221a	Curriculum Component	Major subject		
Credit (--Unit)	3 Units	LECTURE (Unit-Hours)	Units - 3 Hours	LABORATORY (Unit-Hours)	o Units - o Hours
Prerequisites	None	Co-requisites	None	Year Level/Semester Offered	2nd - Second Semester
Course Description	This is an introductory in ordinary differential equations (ODEs). It focuses primarily on techniques for finding explicit solutions to linear ODEs. Topics include first order ordinary differential equations, linear differential equations, linear equations with constant coefficients, nonhomogeneous equations, undetermined coefficients and variation of parameters, linear systems of equations, the existence and uniqueness of solutions.				
Faculty In charge					
Consultation Hours	Contact Information				

PROGRAM EDUCATIONAL OBJECTIVES (PEO)		MISSION		
In 3-5 years, the BS Applied Mathematics graduates of USM shall:		M1	M2	M3
PEO 1	Provide leadership in various development programs both public and private	✓		
PEO 2	Equip with technical, conceptual and human resource skills	✓		
PEO 3	Pursue entrepreneurial activities	✓		✓
PEO 4	Able to adapt to diverse culture	✓		✓
PEO 5	Pursue advanced studies in emerging related fields		✓	
NOTE: The PEO's are based on the professional, industry, local, national and international needs and requirements of the program identified through consultation with constituents and stakeholders.			✓	✓



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### PROGRAM OUTCOMES (PO)

Upon graduation, the University of Southern Mindanao **BS Applied Mathematics** students must be able to:

	PEO1	PEO2	PEO3	PEO4	PEO5	PEO6	PEO7	PEO8	PEO9	PEO10	...
a.) Articulate and discuss the latest development in the specific field of practice.		✓									
b.) Effectively communicate orally and in writing using both English and Filipino.		✓									
c.) Work effectively and independently in multidisciplinary and multi-cultural teams.			✓	✓	✓						
d.) Act in recognition of professional, social and ethical responsibility.	✓										
e.) Preserve and promote "Filipino historical and cultural heritage".				✓							
f.) Participate in the generation of new knowledge in research and development projects.		✓									
g.) Articulate the rootedness of education in philosophical, sociocultural, historical and psychological and political context.		✓									
h.) Demonstrate mastery of subject matter/discipline.		✓									
i.) Facilitate learning using wide range of teaching methodologies and delivery modes appropriate to specific learners and their environment.		✓	✓								
j.) Develop innovative curricula, instructional plans, teaching approaches, and resources for diverse learners.		✓		✓							
k.) Apply skills in the development and utilization of ICT to promote quality, relevant and sustainable educational practices		✓									
l.) Demonstrate a variety of thinking skills in planning, monitoring, assessing and reporting learning processes and outcomes.		✓									
m.) Practice professional and ethical teaching standards sensitive to the local, national and global realities.	✓			✓							
n.) Pursue lifelong learning for personal and professional growth through varied experiential and field based opportunities					✓						
o.) Exhibit competence in mathematical concepts and procedures		✓									
p.) Exhibit proficiency in relating mathematics to other curricular areas		✓									
q.) Gain mastery in the cores areas of mathematics: algebra, analysis, and geometry.		✓									
r.) Demonstrate skills in pattern recognition, generalization, abstraction, critical analysis, synthesis, problem-solving and rigorous argument.		✓									
s.) Develop an enhanced perception of the vitality and importance of mathematics in the modern world including inter-relationships within math and its connection to other disciplines.		✓									
t.) Appreciate the concept and role of proof and reasoning and demonstrate knowledge in reading and writing mathematical proofs.		✓									
u.) Make and evaluate mathematical conjectures and arguments and validate their own mathematical thinking.		✓									
v.) Communicate mathematical ideas orally and in writing using clear and precise language.		✓									

NOTE: Minimum PO's shall come from the PSG/CMO of the program if applicable. Other additional PO's may come from consultations with constituents and stakeholders.



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COURSE OUTCOMES (CO)		POa	POb	POc	POd	POe	POf	POg	POh	POi	POj	POk	POl	POm	POn	POo	POp	POq	POr	POs	POt	POu	POv	POw	POx	POy	POz
Upon passing this course, the students must be able to:		Course Alignment to Program Outcomes																									
CO 1	Familiarization of basic concepts and applications of ordinary differential equations																E			E	E	E	E				
CO 2	Identifying and able to find the solutions for separable and linear first-order equations																E			E	E	E	E				
CO 3	Finding the solutions using substitution and integrating factors for exact equations and Bernoulli equations																E			E	E	E	E				
CO 4	Introduction to systems of linear ordinary differential equations and its solution																E			E	E	E	E				

\* Level (follow the legend used in the most relevant PSG/CMO)

[I] = Introductory. This introduces the student to the Program Outcome (PO).

[E] = Enabling. This enables the student to attain the Program Outcome (PO)

[D] = Demonstrative. This demonstrates the student's attainment of the Program Outcome (PO)

### COURSE LEARNING PLAN

Intended Learning Outcomes (ILO) By the end of the learning experience*, students must be able to	Aligned to CO	Time Frame (Week)	Course Content (Topic)	Teaching & Learning Activities (TLA)		Learning Materials	Assessment Tasks (AT)	Suggested Readings
				Teaching Activities	Learning Activities			
1.1 Explain the vision, mission, UQPS of the University 1.2 Explain the goals and objectives of the college. 1.3 Explain the Program Educational Objectives, Students Outcomes, and Course Outcomes.		1	<b>Orientation on Classroom and University Policies as well as Grading System</b> • Discussion on PEO, SO and CO	Orientation Lecture/Discussion	Reading; Assignment	Computer; Chalkboard	Recitation	[1]
2.1 Familiarize basic concepts and terminologies in ODE 2.2 Classify ODEs types and order 2.3 Solve initial value problems 2.4 See the importance and application	CO1	2-3	<b>Basic Concepts and Terminology</b> • Differential Equations: Basic Definitions • Classifications of ordinary differential equations (order,	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book/PDF Projector Laptop/PC Instructional	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 1-17 [6][7][8]

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### COURSE LEARNING PLAN

Intended Learning Outcomes (ILO)  
By the end of the learning experience\*, students must be able to

Aligned to CO: \_\_\_\_\_

Time Frame (Week)

Course Content (Topics)

Teaching & Learning Activities (TLA)  
Teaching Activities      Learning Activities

Learning Materials

Assessment Tasks (AT)

Suggested Readings

of ODE in real life			ordinary(partial) • Initial Value Problems • Importance of Differential Equations and Some Illustrative Examples			Module		
3.1 Use direct integration and differentiation in some simple ODE equations	CO1	4	<b>Integration and Differential Equations</b> • Directly-integrable equation • On using indefinite integrals • On using definite integrals	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 18-34 [6][7][8]
4.1 Define and identify separability 4.2 Write an equation to separation of variables form 4.3 Find the solutions for separable equations 4.4 Summarize and apply the general procedure for solving separable of first-order differential equations	CO2	5-6	<b>Separable First-Order Equations</b> • Basic notions of separability • General equation form for separation of variables • Solution of separable equations • The general procedure for solving separable of first-order differential equations	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	2][3][4][5]pp. 65-92 [6][7]pp. 18-32[8]
5.1 Define linear first-order differential equations 5.2 Transform the equation into Linear First-order equations 5.3 Find the solutions for first-order linear equations	CO2	7-8	<b>Linear First-Order Equations</b> • Basic notions and definitions • Solution derivation technique • Solving for First-order Linear Equations • On Using Definite Integrals with Linear Equations • Integrability, Existence and Uniqueness	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book\PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 93-104 [6][7]pp. 18-32 [8]

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### COURSE LEARNING PLAN

Intended Learning Outcomes (ILO) By the end of the learning experience <sup>3</sup> , students must be able to:	Aligned to CO:	Time Frame (Week)	Course Content (Topics)	Teaching & Learning Activities (TLA) Teaching Activities	Learning Activities	Learning Materials	Assessment Tasks (AT)	Suggested Readings
<b>All ILOs covered in Midterm</b>								
6.1 Simplify ODEs by substitution 6.2 Summarize and apply the general procedure in simplifying through substitution	CO <sub>3</sub>	9 10-11	<b>Simplifying Through Substitution</b> <ul style="list-style-type: none"> <li>Basic notions</li> <li>General procedure in simplifying through substitution</li> <li>Linear substitution</li> </ul>	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book/PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 105-110 [6][7][8]
7.1 Define homogeneous differential equations 7.2 Find the solutions for homogeneous differential equations	CO <sub>3</sub>	12	<b>Homogeneous Equations</b> <ul style="list-style-type: none"> <li>Definition</li> <li>Examples</li> <li>Steps in solving homogeneous equations</li> </ul>	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book/PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp.111-113 [6][7][8]
8.1 Define Bernoulli equations and give examples 8.2 Find the solutions for Bernoulli equations	CO <sub>3</sub>	13	<b>Bernoulli Equations</b> <ul style="list-style-type: none"> <li>Definitions and examples</li> <li>Steps in solving Bernoulli Equations</li> </ul>	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book/PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	Powell p.113-116 [2][3][4][5]pp. 113-116 [6][7][8]
9.1 Recall the chain rule 9.2 Define the exact equation 9.3 Convert the equation to its exact equation form 9.4 Solve equations in exact form	CO <sub>3</sub>	14-15	<b>Solving Exact Equations</b> <ul style="list-style-type: none"> <li>Definition of exact equations</li> <li>Exact equation form</li> <li>Solving equations in exact form</li> <li>Converting equations to exact form</li> </ul>	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book/PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 117-131 [6][7][8]
10.1 Derive integrating factors	CO <sub>3</sub>		<b>Solving using Integrating</b>	Lecture/Video	Discussion	Chalkboard/	Assignments	

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COURSE LEARNING PLAN								
Intended Learning Outcomes (ILO) By the end of the learning experience*, students must be able to:	Aligned to CO:	Time Frame (Week)	Course Content (Topics)	Teaching & Learning Activities (TLA)		Learning Materials	Assessment Tasks (AT)	Suggested Readings
				Teaching Activities	Learning Activities			
<b>10.2</b> Finding the solutions using integrating factors using general approach and 3 cases		16	<b>Factors</b> <ul style="list-style-type: none"> <li>General approach</li> <li>Case 1: <math>\mu</math> being a function of <math>x</math> only</li> <li>Case 2: <math>\mu</math> being a function of <math>y</math> only</li> <li>Case 3: <math>\mu</math> Being a 'Simple' Function of Both Variables</li> </ul>	Presentation/addressing students questions Zoom video conference Module	Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Whiteboard Book/PDF Projector Laptop/PC Instructional Module	Quizzes Exams Reflective paper USM VLE Exercises	[2][3][4][5]pp. 117-131 [6][7][8]
<b>11.1</b> Define and give examples of systems of linear equations <b>11.2</b> Familiarize with its solutions	CO4	17	<b>Systems of Linear Equations</b> <ul style="list-style-type: none"> <li>Definition and examples</li> <li>Local existence Theorem</li> <li>Uniqueness Theorem</li> <li>Global existence Theorem</li> </ul>	Lecture/Video Presentation/addressing students questions Zoom video conference Module	Discussion Board work Seat work Group Reporting USM VLE/ MyOpenMath Task	Chalkboard/ Whiteboard Book/PDF Projector Laptop/PC Instructional Module	Assignments Quizzes Exams Reflective paper USM VLE Exercises	[2]pp. 71-73 [3][4][5]pp. 117-131 [6][7][8]
<b>All ILOs covered in the Course</b>		18	<b>FINAL EXAMINATION</b>					

\* any interaction, course, program, or other experience in which learning takes place (<https://www.edglossary.org/learning-experience/>).

#### Textbook/References

- [1] USM Student Manual
- [2] Ahmad, S. & Ambrosetti, A. (2015) A textbook on Ordinary Differential Equations, 2<sup>nd</sup> Ed. New York: Springer.
- [3] Bronson, R. & Costa, G.B. (2014). Schaum's Outline Differential Equations. New York: McGraw Hill. Available at: [https://prodifisikauhn.gnomio.com/pluginfile.php/455/mod\\_resource/content/1/Differential%20equation.pdf](https://prodifisikauhn.gnomio.com/pluginfile.php/455/mod_resource/content/1/Differential%20equation.pdf)
- [4] Edwards, C.H. & Penney, D.E. (2007). Elementary Differential Equations, 6<sup>th</sup> Edition. USA: Pearson. Available at: <http://mercury.pr.erau.edu/~thomasr/de/DEBooks1/2C. Henry Edwards, David E. Penney Elementary Differential Equations -6th Edition- Prentice Hall pp648.pdf>
- [5] Howell, K.B. (2020). Ordinary Differential Equations: An Introduction to Fundamentals, 2<sup>nd</sup> Ed. New York: CRC Press.
- [6] Nagle, R.K., Staff, E.B., and Snider, A.D., (2000) Fundamentals of Differential Equations and Boundary Value Problems. Addison-Wesley. Available at: <http://xn--webeducation-dbb.com/wp-content/uploads/2020/06/R.-Kent-Nagle-Edward-B.-Saff-Arthur-David-Snider-Fundamentals-of-Differential-Equations-Pearson-2017.pdf>
- [7] Rainville, E.D., Bedient, P.E., and Bedient, R.E. (1997), Elementary Differential Equations, 8<sup>th</sup> Edition, USA: Pearson.
- [8] Trench, W. (2013). Elementary Differential Equations. USA: Brooks/Cole Thomson Learning. Available at: [http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH\\_DIFF\\_EQNS\\_I.PDF](http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_DIFF_EQNS_I.PDF)

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## Life-long Learning Opportunity

Apply the concepts and theories of Ordinary Differential Equations to the real life applications such as in economics, physics, mathematical biology (i.e. population growth), engineering, applied mathematics and other areas.

## Course Evaluation

Course Outcomes (CO)	Assessment Task Addressing CO	Weight (%)	Satisfactory Rating	Target Standard
CO1: Familiarization of basic concepts and applications of ordinary differential equations	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO2: Identifying and able to find the solutions for separable and linear first-order equations	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO3: Finding the solutions using substitution and integrating factors for exact equations and Bernoulli equations	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		
CO4: Introduction to systems of linear ordinary differential equations and its solutions	Quizzes/Assignments/Others	60	60	90% of the class obtained a satisfactory rating
	Major Exam	40		

## Grading System

## Midterm Grade

Quizzes-----40%  
Assignments/Others-----30%  
Midterm Exam-----30%

## Final Grade

50% Midterm Grade+50% Final Term Grade

## Final Term Grade

Quizzes/Summative Exams-----40%  
Assignments/Others-----30%  
Final Exam-----30%

## Passing Grade

60%



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Classroom Policies

1. Come to class prepared for recitation, class discussions, or unannounced quizzes always. Demonstrate personal responsibility by obtaining notes and finding out any instructions/important announcements given on the class period missed.
2. Absence is not a right, nor a privilege. The University Code on absence and tardiness applies. 20% of the total class hours means you are DROPPED from the course. Absences can be excused only after presenting official documents.
3. All submissions must be your original work. Cite sources properly. Plagiarism and any form of academic cheating get a corresponding grade of 5.0 (Failed) and can be grounds for suspension or expulsion.
4. During online class, students are expected to:
  - a. Show up on a scheduled time and wait to be admitted into the class.
  - b. Be always respectful. If your video is on, avoid hand gestures or inappropriate language.
  - c. Stay on mute. Click a raise hand button if you have a question or something to share.
  - d. Stay focused and on task so you don't miss anything the speaker says.
  - e. Class participation is highly encouraged.
5. Consultation: You can approach your class mayor for your concerns so he/she will relay them once to your professor
6. All information and queries regarding our class will be posted in our official group chat or facebook group. Refrain from posting unrelated topics in these platforms as these will take up space in the messenger box and will make it difficult to backread important messages.
7. Observe proper decorum when sending messages to your professors.
8. Avoid sending messages online outside office hours or during evening.
9. All submissions must be in USM VLE. Submissions made outside VLE will not be accepted.